the generative nuclei. But is such an interpretation possible? I think not.

On harvesting the plants the grain was found to be badly shrivelled, the Michigan Bronze crosses only producing three grains, none of which germinated. From about three hundred grains of the Rivet and Red King crosses, two hundred and sixty plants were raised. The rust appeared on these as early as March 16, and by June 15 many plants were orange-coloured even on the highest leaves. On counting out the plot, 78 plants were found to be free from disease, 118 were slightly infected, and 64 were badly attacked. By June 29 the epidemic seemed to be at its height, and a second count showed that the number of disease-free plants was reduced to 64, while 195 were infected, for the most part badly.[1]

These figures seem to be too close an approximation to the Mendelian ratio of 1 : 3 to be a mere accident, especially when taken in conjunction with the results of the first generation. The susceptibility of wheat to the attacks of rust is therefore a definite Mendelian character.

If further researches should show that this capacity for resisting the attacks of disease-producing fungi is in reality a tangible characteristic, the plant-breeder, at all events, will have definite lines to go upon in attempting to solve one of our most important agricultural problems, namely, that of producing disease-resisting strains.

R. H. BIFFEN.

PROBABLE ERROR IN VITAL STATISTICS.

A PAPER on "The Degree of Accuracy of Statistical Data," by Mr. Carl C. Engberg, has been published by the University of Nebraska. "This paper," Mr. Engberg tells us, "is written as a protest against the unnecessary refinement of statistical computations as carried out by the biometricians of to-day." Mr. Engberg complains that the more "prominent biometricians" have worked with five or six figures when they might have worked with three or four with equally good results. He illustrates this by comparing Prof. Pearson's work on enteric fever, published in 1894, with a revision of it by himself using only three places of decimals. He considers that the one is as good as the other. He does not, however, apply the test for relative goodness of fit of observation to theory—*Phil. Mag.*, July, 1900—but discards it without examining the analysis by which it is reached, on the basis of a paradox that he has not been able to see through. He appears to dislike the test because if 16,000 observations are distributed in the same proportions in n groups as 1000 observations the former distribution shows a lower probability for the fit than the latter, if the same curve be used in both cases. This, however, must be right. 16,000 observations should give a result nearer a smooth curve than 1000. The percentage error has been discarded for years by trained biometricians; it was merely a temporary *modus vivendi.*

As to the use of a greater or less number of decimal places, to those who work with mechanical calculators the number is practically indifferent, and to trained computators even a 7 or 10 figure table of logarithms is hardly slower in use than a 4 or 5 figure table. But are the decimal places when reached worth having? Very often not, very often they are. Mr. Engberg seems quite incapable of distinguishing between the two classes of cases. The only means of testing is to consider the probable errors of the results. The theory of the probable errors of the constants of frequency curves was not given until 1898, and it was not possible to say in 1894 how many places of decimals were or were not necessary. Mr. Engberg appears to think that because vital statistics are tabled to one or even four year units, it is impossible to ascertain the values of constants to two or three decimal places of those units. He states, vaguely, that "the constants cannot be more accurate than the data upon which they are based." He might well have asked the American actuaries for their views on this point! Practical men do not work to 6 or 10 figures for the mere pleasure of it, and in the particular case cited by Mr. Engberg—"Makeham's c"—we have a constant which has often to be raised to the fiftieth power! Does Mr. Engberg believe that the mean age at death of a population of several millions, classified solely by year of age at death, cannot be found to less than the rough year which is the basis of the grouping?

Mr. Engberg says that his "paper has not been written in a fault-finding spirit by a detractor of the new science of biometry, but by a teacher of the science." It seems a pity that Mr. Engberg should not have studied either the history or literature of the science he is teaching, or, apparently, have received a training in mathematical statistics. In the former case he would have known that the method he suggests on p. 9 has been long in use (Yule, *Proceedings* of Royal Statistical Society, vol. lx., part iv., 1897), and the inner meaning of tables of powers for testing the *last* column of high moment tables would have been obvious to him. In the latter case he would have made a valid criticism of over-many decimal places by simply showing that they gave results beyond the probable error of the constant involved, or did not improve the goodness of fit as tested by a legitimate method. We are doubtful whether the growing practice of appointing teachers of biometry in the American universities without preliminary training is really helping the science forward. It leads, it is true, to a multitude of biometric papers, but very few of these are of permanent scientific value.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—On Thursday, November 19, an election took place of great importance in relation to the advancement of the study of mental science in Oxford—that of Dr. W. MacDougall to the readership in psychology founded some years ago by Mr. Wilde. The first reader was Mr. Stout, the well-known editor of *Mind,* who last summer resigned the Oxford appointment for a professorship at St. Andrews. His successor will no doubt follow in Mr. Stout's footsteps, but those who appreciate the value of the experimental method in psychology confidently anticipate that opportunity will now be given for this study in Oxford. Dr. MacDougall has himself approached the subject from the experimental side, and is the author of very important researches on the physiology of the nervous system, among which those relating to the theory of colour vision may be taken as examples. As a member of the Cambridge Anthropological Expedition to Torres Straits and Borneo, he conducted experimental researches on the mental processes of savages, which afford substantial evidence of his power as an investigator. When to this it is added that he is no less a master of the older methods than of the new, and is regarded as a man of power alike by physiologists and by philosophers, the university may well be congratulated on so valuable an accession to its intellectual forces. Against any regret that may be felt that the new reader is not an Oxford man, the fact may be set off that one of the most successful and influential of American experimental psychologists—Prof. Titchener—received his training in both sides of the subject at Oxford.

CAMBRIDGE.—Dr. Hobson, F.R.S., has been appointed the first Stokes lecturer, and Dr. Baker, F.R.S., the first Cayley lecturer, in mathematics.

An Isaac Newton Studentship of 200*l.* a year for three years, for research in astronomy and astronomical physics, will be vacant in the Lent term, 1904. Candidates must be bachelors of arts under twenty-five years of age. Applications are to be sent to the Vice-Chancellor by January 26.

The degree of D.Litt. is to be conferred *honoris causa* on Prof. Théophile Homolle, member of the Institute of France, director of the French School of Athens.

Prof. Woodhead, Mr. J. E. Purvis, Dr. Tatham, Dr. Lane Notter, and Dr. R. D. Sweeting have been appointed examiners in State medicine for the diploma in public health.

The scheme for the establishment of a geographical school and the institution of a special examination in geography and a diploma in geography will be submitted to Senate for adoption on December 5.

---

[1] One plant overlooked.

© 1903 Nature Publishing Group

Prof. William F. Durand, professor of marine engineering, has been appointed acting director of Sibley College, Cornell University, in succession to the late Prof. Thurston.

Dr. Morris W. Travers has been appointed professor of chemistry in University College, Bristol, in succession to Prof. Sydney Young, F.R.S. Dr. F. E. Francis, lecturer in chemistry, has been promoted to the rank of assistant professor in the college.

Speaking at Limerick last week in distributing prizes to the pupils of the Municipal Technical, Science and Art Schools, Sir Horace Plunkett remarked that the whole country had now taken up the work of technical education with a quickness, receptivity, and responsiveness which he was told by educational experts had not been witnessed in any country under similar economic conditions, and in so short a time. There was now scarcely a corner of Ireland where the people were not showing an anxiety and practical interest to take up a scheme which had been introduced under the auspices of the Department of Agriculture and Technical Instruction.

In the course of an address at Liverpool on Saturday last Sir Philip Magnus remarked that our very existence as a nation depended upon our continued educational advance. There was a startling contrast between the liberal expenditure in America and Germany upon specialised university research and the small sums spent here. This country had little to learn from the method of teaching in American schools, but what we could and must learn if we were to recover lost ground was a changed attitude towards education itself. Few manufacturers in this country yet realised the economy and industrial advantages of attaching to their works intelligence departments staffed with scientific experts. He was glad to say, however, even in this respect the outlook was improving, and there were many signs of brighter days in store.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 19.—"The Sensation of Light produced by Radium Rays, and its Relation to the Visual Purple." By W. B. **Hardy** and H. K. **Anderson.**

When a few milligrammes of radium bromide are brought near the head in the dark a sensation of diffuse light is produced. The authors find that this is not due to any direct response on the part of the retina, the optic nerve, or the brain, but to a fluorescence of the tissues of the eyeball, notably of the lens and of the retina itself, excited by the β and γ rays.

The visual purple of the retina is not bleached by any of the radium rays.

The authors point out in passing the peculiarly high opacity of the eyelid to the rays, as compared with the skin of other parts of the body.

Physical Society, November 13.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Sir Oliver J. **Lodge** read a paper on means for electrifying the atmosphere on a large scale. Twenty years ago the author was engaged with Mr. J. W. Clark on an investigation of the dark spaces seen near hot bodies placed in illuminated smoke. The existence of these dust-free spaces was discovered by Tyndall, and the phenomenon had been investigated by Lord Rayleigh. Tyndall worked with high temperatures, and attributed the effect to the burning of the dust near the hot body. Such, however, cannot be the case, as the spaces exist when inorganic dust, such as oxide of magnesium, is used. The conclusion at which Messrs. Lodge and Clark arrived (see *Phil. Mag.*, 1884) was that the result was due to an aërial bombardment from the hot wire which drove the particles away, and they tried the effect of electrifying the hot body to see if there was any modification of the dark space. A new phenomenon was discovered, the whole of the dust being driven to the sides of the containing vessel. This experiment was shown by the author at the British Association meeting in Montreal in 1884, and subsequently, on a larger scale, at the Royal Institution. In the latter experiment two pieces of wire gauze, connected to the terminals of an electric machine, were placed opposite each other in a smoke-filled chamber, through which a current of smoke was slowly passing. Upon electrifying the plates the smoke ceased passing, the dust particles cohered, hovered in the air, and were either driven to the sides of the chamber or fell to the bottom. In the case of mist, electrification of steam in a bell jar converted it into fine rain. It seems therefore possible that rain might be produced by the electrification of a cloud. Sir Oliver Lodge has tried at Liverpool to disperse fogs by discharging electricity into them. For this purpose a large mast was erected on the roof of the University College buildings. It terminated in a bundle of points, to which electricity was conveyed from a Wimshurst machine by a wire supported by specially constructed insulators. In order to drive electricity from a point far removed from a surface a high potential is necessary, and sometimes a large gas flame was used to supplement the points. Upon one occasion the discharge of electricity from the flame was sufficient to keep a clear space of 50 or 60 yards radius in a dense fog. The author had hoped to induce the Mersey Dock Board to try the principle on a large scale, having a series of positive discharges on one side of the river and a series of negative discharges on the other; but he felt a certain reluctance in recommending the method to practical men so long as it was necessary to derive the current from a Wimshurst machine. A dynamo would be a more suitable generator if it were possible to get a sufficiently high potential. The way out of the difficulty is to rectify a high-tension alternating current, and Sir Oliver Lodge has for some time been considering the possibility of doing this by utilising Cooper-Hewitt mercury lamps. A study of these lamps has led him to believe that their rectifying power is much assisted by the outside metallic coating which surrounds the mercury electrode, and which is connected to the positive terminal of the lamp. In order to rectify an alternating discharge, four lamps are so arranged in the form of a quadrilateral that, when the leads from the terminals of an alternating transformer are connected to two opposite corners, two unidirectional currents are obtained from the other corners. Experiments have been made at Birmingham by sending the current from a high-frequency alternator (3000 ~ per sec.) through the primary of an induction-coil and connecting the terminals of the secondary to the rectifiers. The length of the rectified spark can be increased by putting a number of lamps in series in each arm of the quadrilateral arrangement. Sir Oliver Lodge performed an experiment at the meeting to show the dissipation of fog by electrification. The current from an alternator was passed through the primary of a coil and the terminals of the secondary connected to the rectifiers, twelve lamps in all, three in series in each arm. This arrangement is capable of giving a rectified spark 2 or 3 inches long, the unidirectional nature of which can be proved by passing it through a Crookes or a Röntgen tube. Some magnesium wire having been burnt under a large bell jar to fill it with a cloud of magnesium oxide, the jar was then illuminated by the light from an electric lamp. Passing through the base-piece upon which the bell-jar was placed was a conductor which terminated in a point inside the jar. When the terminals between which the rectified discharge was passing were separated and the other end of this conductor was joined to one of them, the electricity streaming from the point into the clouded atmosphere caused an immediate deposition of the magnesium oxide.—Sir Oliver **Lodge** also described an arrangement for driving mercury pumps, designed by Mr. B. Davies and himself.

Chemical Society, November 5.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—The reduction of hydrazoic acid, by Mr. W. T. **Cooke.** The products were hydrazine and ammonia in place of the expected cyclic nitrogen hydride.—Preliminary note on the viscosity of liquid mixtures, by Messrs. A. E. **Dunstan** and W. H. C. **Jemmett.** The viscosity curve of a mixture of two non-associated liquids is a straight line, of a non-associated with an associated liquid, a line convex to the axes, and of two associated liquids, a line concave to the axes.—Contribution to the study of the reactions of hydrogen peroxide, by Mr. J. **McLachlan.** The evolution of oxygen induced by the addition of solutions of hydrogen peroxide to acidified solutions of potassium

© 1903 Nature Publishing Group